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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/173,129 | 10/15/1998 | SONG C. PARK | TI-25320 | 1320 |

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| EXAMINER |
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PERALTA, GINETTE

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| ART UNIT | PAPER NUMBER |
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2814

DATE MAILED: 11/05/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/173,129

Applicant(s)

PARK ET AL.

Examiner

Ginette Peralta

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 July 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,5-9,12-16 and 19-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-9,12-16 and 19-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-2, 5-9, 12-16, 19-32 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The inclusion of the limitation of "an explosive reaction" is not enabled by the applicant's specification. Furthermore, the limitation of "introducing O₂ and H₂ in an explosive reaction to said insulating layer, said silicon-containing structure and said conductive structure" is not enabled, as the O₂ and H₂ are introduced to the chamber but not to the insulating layer, the silicon-containing structure or the conductive structure.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

4. Claims 1-2, 5-9,12-15, 20-23 and 27-28 are rejected under 35 U.S.C. 102(e) as being anticipated by Tanabe et al. (U. S. Pat. 6,197,702 B1).

Regarding claims 1 and 26, Tanabe et al. shows in col. 13, ll. 20 to col. 16, ll. 67, a method of fabricating, in a semiconductor processing chamber, an electrical device formed in a semiconductor substrate, the method comprising forming an insulating layer 9 over the semiconductor substrate; forming a silicon-containing structure 10 on the insulating layer; forming a conductive structure 11,12 on the silicon-containing structure; and oxidizing a portion of the insulating layer and the silicon containing structure while leaving the conductive structure substantially unoxidized by introducing O₂ and H₂ to a reaction chamber and exposing the insulating layer, the silicon-containing structure and the conductive structure to the gases, such that the reaction between the O₂ and the H₂ does not increase the pressure in the processing chamber beyond a predetermined safe level.

Regarding claim 2, Tanabe et al. shows the electrical device may be one of a memory device, a transistor, a logic device, or a capacitor(col. 11, ll. 21- col. 12, ll. 20).

Regarding claim 5, Tanabe et al. shows the insulating layer 9 comprises silicon oxide (col. 13, ll. 24-25).

Regarding claim 6, Tanabe et al. shows the silicon-containing structure comprises doped polycrystalline silicon (col. 13, ll. 47).

Regarding claim 7, Tanabe et al. shows the conductive structure is comprised of an oxygen-sensitive material, in the instant case, tungsten (col. 15, ll. 38-52).

Regarding claim 8, Tanabe et al. shows the conductive structure comprises tungsten (col. 13, ll. 50-53, col. 15, ll. 38-52).

Regarding claim 9, Tanabe et al. teaches a method of oxidizing, in a semiconductor processing chamber, a first feature while leaving a second feature substantially unoxidized (col. 15, ll. 38-61), the method comprises subjecting the first and second features to O_2 and H_2 in a reaction, such that the reaction between the O_2 and the H_2 does not increase the pressure in the processing chamber beyond a predetermined safe level.

Regarding claim 12, Tanabe et al. shows the first feature 14A, 14B or 14C, comprising polycrystalline silicon (col. 13, ll. 48).

Regarding claim 13, Tanabe et al. shows the first feature 14A, 14B or 14C, comprising silicon oxide (col. 13, ll. 24).

Regarding claim 14, Tanabe et al. shows the first feature 14A, 14B or 14C, comprising a dielectric material 9.

Regarding claim 15, Tanabe et al. shows the second feature 14A, 14B or 14C, comprising tungsten (col. 13, ll. 50).

Regarding claims 20 and 27, Tanabe et al. shows the oxidizing of a portion of the insulating layer and the silicon-containing structure while leaving the conductive structure substantially unoxidized by introducing O₂ and H₂ in a reaction in a portion of a process chamber's total volume, such that the reaction between the O₂ and the H₂ occurs continuously as the O₂ and H₂ enter the chamber (col. 14, ll. 56-65).

Regarding claims 21, 23, and 28 Tanabe et al. shows the oxidizing step including the introduction of the O₂ and H₂ in a predetermined ratio and mass flow controllers for opening or closing the passage of gases, by which the amount and component ratio of the gases introduced into the reactor are controlled precisely (col. 14, ll. 56-65).

Regarding claim 22, Tanabe et al. shows the introduction of the O₂ and H₂ in a reaction in a portion of a process chamber's total volume, such that the reaction between the O₂ and H₂ occurs continuously at the O₂ and H₂ enter the chamber (col. 15, ll. 1-12).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 29, 30, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanabe et al..

Tanabe et al. shows in col. 13, ll. 20 to col. 16, ll. 67, a method of fabricating, in a semiconductor processing chamber, an electrical device formed in a semiconductor substrate, the method comprising forming an insulating layer 9 over the semiconductor substrate; forming a silicon-containing structure 10 on the insulating layer; forming a conductive structure 11,12 on the silicon-containing structure; and oxidizing a portion of the insulating layer and the silicon containing structure while leaving the conductive structure substantially unoxidized by introducing O₂ and H₂ to a reaction chamber and exposing the insulating layer, the silicon-containing structure and the conductive structure to the gases, such that the reaction between the O₂ and the H₂ does not increase the pressure in the processing chamber beyond a predetermined safe level.

Thus, Tanabe et al. is shown to teach all of the features of the claim with the exception of introducing the O₂ and H₂ at a low pressure and increasing the pressure of the chamber as the reaction begins.

It would have been within the scope of one of ordinary skill in the art to vary the concentration of one of the reactants after the introduction into the chamber of the gases and the reaction begins, in order to form an oxide with a desired thickness, therefore it

would not yield any unexpected results as the selectivity towards the conductive structure is maintained by the use of specific reactive gases, and that the reaction occurs continuously as the O₂ and H₂ enter the chamber as the gases are introduced at a temperature where the reaction is favored, and the total pressure is controlled by starting the flow of hydrogen at a lower pressure in order to prevent a violent reaction.

7. Claims 16, 19, 24-25 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng (U. S. Pat. 5,814,526) in view of Tanabe et al..

Regarding claim 16, Tseng shows a method of fabricating a capacitor having a dielectric between a bottom electrode and a top electrode and situated over a semiconductor substrate, the method comprising providing a bottom electrode 44 over the semiconductor substrate; providing a dielectric material 46 over the bottom electrode 44, wherein the bottom electrode may be formed of polysilicon or a tungsten compound, and the dielectric material is a oxide/nitride/oxide layer formed by a series of depositions that include exposing the structure to a dry oxygen ambient to form the top oxide layer.

Tseng shows all the features in the claim with the exception of subjecting the bottom electrode and the dielectric material to O₂ and H₂ in a reaction, wherein the dielectric material is oxidized and the bottom electrode remains substantially unoxidized.

Tanabe et al. shows a method of subjecting a conductive structure containing a polycrystalline silicon and/or tungsten compound, and a dielectric layer to O₂ and H₂

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in a reaction in order to oxidize the dielectric material and maintaining the conductive structure substantially unoxidized, in a way that the reaction between the O₂ and the H₂ does not increase the pressure in the processing chamber beyond a predetermined safe level, for the disclosed intended purpose of reducing or eliminating the oxidation of the conductive material that would incur in an increase in the resistance of the material of the partial peel off of the film from the substrate.

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the oxidation method taught by Tanabe et al. in the invention of Tseng when treating the dielectric layer of Tseng for the disclosed intended purpose of Tanabe et al. of oxidizing the dielectric layer without substantial oxidizing of the conductive structure that could result in an increase in the resistance of the conductive structure or the peeling off of the film from the substrate.

Regarding claim 19, Tseng teaches the dielectric material comprising an oxide/nitride stack(col. 5, ll. 53-61), and also teaches the use of tantalum pentoxide as a dielectric for capacitors(col. 1, ll. 40).

Regarding claim 24, Tseng as modified by Tanabe et al. shows the introduction of the O₂ and H₂ in a reaction in a portion of a process chamber's total volume, such that the reaction between the O₂ and H₂ occurs continuously at the O₂ and H₂ enter the chamber (col. 15, ll. 1-12).

Regarding claim 25, Tseng as modified by Tanabe et al. shows the oxidizing step including the introduction of the O₂ and H₂ in a predetermined ratio and mass flow

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controllers for opening or closing the passage of gases, by which the amount and component ratio of the gases introduced into the reactor are controlled precisely (col. 14, ll. 56-65).

Regarding claim 31, Tseng as modified by Tanabe et al. teaches all the limitations in the claim with the exception of introducing the O₂ and H₂ at a low pressure and increasing the pressure once the reaction begins. Although this feature is not explicitly taught by either Tseng or Tanabe et al., it would have been within the scope of one of ordinary skill in the art to vary the concentration of one of the reactants after the introduction into the chamber of the gases and the reaction begins, in order to form an oxide with a desired thickness, therefore it would not yield any unexpected results as the selectivity towards the conductive structure is maintained by the use of specific reactive gases, and that the reaction occurs continuously as the O₂ and H₂ enter the chamber as the gases are introduced at a temperature where the reaction is favored, and the total pressure is controlled by starting the flow of hydrogen at a lower pressure in order to prevent a violent reaction.

Response to Arguments

8. Applicant's arguments with respect to claims 1-2, 5-9, 12-16, 19-32 have been considered but are moot in view of the new ground(s) of rejection.

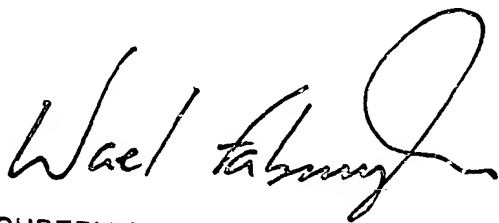
With regards to Applicant's argument that the specification clearly describes a reaction that is well known as an explosive reaction to those skilled in the art, it is noted that there is no language in the specification to support the term "explosive".

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ginette Peralta whose telephone number is (703)305-7722. The examiner can normally be reached on Monday to Friday 8:00 AM- 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703)306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7722 for regular communications and (703)308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

GP
October 31, 2002


SUPERVISORY PRIMARY EXAMINER
TECHNOLOGY CENTER 2800